CLAIM LISTING

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A chemical-vapor deposition ~~method~~ process for forming branched carbon nanotubes comprising:

providing a first precursor material comprising a catalyst for catalyzing the formation of a carbon nanotube according to a chemical-vapor deposition process, wherein the catalyst is capable of forming a carbide when reacted with carbon;

providing a second precursor material comprising a dopant, wherein the dopant is capable of forming a carbide when reacted with carbon, wherein the second precursor material is tetrakis(diethylamino)titanium;

mixing the first and second precursor materials together;

vaporizing the precursor materials;

heating the vaporized mixture of precursor materials to a reaction temperature in a reactor, wherein the carbide-forming reaction of the dopant is more thermodynamically favorable than the carbide-forming reaction of the catalyst at the reactor conditions;

providing a carbon source to the reactor;

vaporizing the carbon source;

heating the vaporized carbon source to the reaction temperature in the reactor; and

forming a carbon nanotube in the reactor according to a chemical-vapor deposition process, wherein the carbon nanotube comprises one or more branches.

2. (Original) The process of claim 1, wherein the carbon source is an organic solvent.

3. (Original) The process of claim 2, wherein the organic solvent is selected from the group consisting of xylene, ethylene, and benzene.

4. (Original) The process of claim 1, wherein the catalyst is iron.

5. (Original) The process of claim 1, wherein the first precursor material comprising the catalyst is a mettallocene.

6. Cancelled.

7. Cancelled.

8. (Original) The process of claim 1, wherein the catalyst is provided to the reactor at an atomic percentage of less than about 0.75 at.%.

9. (Original) The process of claim 1, wherein the catalyst is provided to the reactor at an atomic percentage of between about 0.2 at.% and about 0.7 at.%.

10. (Original) The process of claim 1, wherein the dopant is provided to the reactor at an atomic percentage of between about 0.5 at.% and 4 at.%.

11. (Original) The process of claim 1, wherein the dopant is provided to the reactor at an atomic percentage of between about 1 at.% and 3.5 at.%.

12. (Original) The process of claim 1, wherein one or both of the precursor materials are vaporized at a temperature of less than about 250°C.

13. (Original) The process of claim 1, wherein one or both of the precursor materials are vaporized at a temperature of between 125°C and about 175°C.

14. (Original) The process of claim 1, wherein the reaction temperature is between about 650°C and about 850°C.

15. (Original) The process of claim 1, wherein the carbon source is provided to the reactor subsequent to when the vaporized mixture of precursor materials is heated to the reaction temperature.

16. (Original) The process of claim 1, wherein the carbon source is provided to the reactor simultaneous with when the vaporized mixture of precursor materials is heated to the reaction temperature.

17. (Currently Amended) A chemical-vapor deposition ~~method~~ process for forming branched nanotubes comprising:

providing precursor materials ~~comprising~~ including a first precursor material comprising an organic solvent, a second precursor material comprising iron, and a third precursor material comprising a dopant, wherein the dopant is ~~capable of forming a carbide when reacted with carbon~~ selected from the group consisting of titanium, hafnium, and zirconium;

mixing the precursor materials together;

vaporizing the precursor materials;

heating the vaporized precursor materials to a reaction temperature, wherein the carbide-forming reaction of the dopant is more thermodynamically favorable than an iron carbide forming reaction at the reaction temperature;

<u>forming a bimetal catalyst particle, wherein the two metals of the bimetal catalyst particle are the iron of the second precursor material and the dopant of the third precursor material;</u> and

forming a carbon nanotube according to a chemical-vapor deposition process, wherein the carbon nanotube comprises one or more branches.

18. (Original) The process of claim 17, wherein the organic solvent is selected from the group consisting of xylene, benzene, and ethylene.

19. (Original) The process of claim 17, wherein the precursor material comprising iron is ferrocene.

20. Cancelled.

21. (Original) The process of claim 17, wherein iron is provided at an atomic percentage of less than about 0.75 at.%.

22. (Original) The process of claim 17, wherein iron is provided at an atomic percentage of between about 0.2 at.% and about 0.7 at.%.

23. (Original) The process of claim 17, wherein the dopant is provided at an atomic percentage of between about 0.5 at.% and 4 at.%.

24. (Original) The process of claim 17, wherein the mixture of precursor materials is vaporized at a temperature of between 125°C and about 175°C.

25. (Original) The process of claim 17, wherein the reaction temperature is between about 650°C and about 850°C.

26-33. Cancelled.

34. (New) A chemical-vapor deposition process for forming branched nanotubes comprising:

a first growth stage, the first growth stage including the steps of

a) providing a catalyst to a reactor for catalyzing the formation of a carbon nanotube according to a chemical-vapor deposition process, wherein the catalyst is capable of forming a carbide when reacted with carbon;

b) vaporizing the catalyst;

c) providing a carbon source to the reactor;

d) vaporizing the carbon source;

e) heating the catalyst and the carbon source to a reaction temperature in the reactor;

f) forming a carbon nanotube in the reactor according to a chemical-vapor deposition process;

wherein the carbon nanotube develops during the first growth stage with no branching; and

a second growth stage, the second growth stage including the steps of

a) providing a dopant to the reactor, wherein the dopant is capable of forming a carbide when reacted with carbon and the carbide-forming reaction of the dopant is more thermodynamically favorable than the carbide-forming reaction of the catalyst at the reactor conditions, wherein the dopant is provided to the reactor simultaneously with the catalyst only during the second growth stage;

b) vaporizing the dopant;

c) heating the dopant to the reaction temperature;

d) forming a doped catalyst particle, the doped catalyst particle comprising the catalyst and the dopant;

wherein the carbon nanotube develops one or more branches during the second growth stage.

35. (New) The process of claim 34, wherein the carbon source is an organic solvent.

36. (New) The process of claim 35, wherein the organic solvent is selected from the group consisting of xylene, ethylene, and benzene.

37. (New) The process of claim 34, wherein the catalyst is iron.

38. (New) The process of claim 34, wherein the dopant is selected from the group consisting of titanium, hafnium, and zirconium.

39. (New) The process of claim 34, wherein the catalyst is provided to the reactor at an atomic percentage of less than about 0.75 at.%.

40. (New) The process of claim 34, wherein the dopant is provided to the reactor at an atomic percentage of between about 0.5 at.% and 4 at.%.

41. (New) The process of claim 34, wherein the reaction temperature is between about 650°C and about 850°C.